WE CLAIM:

1. A hydrogen purification device, comprising:

an enclosure defining an internal compartment; wherein the enclosure comprises at least a pair of end plates, wherein the enclosure is adapted to receive under pressure through at least one input port a mixed gas stream comprising hydrogen gas and other gases and to separate the mixed gas stream, via a pressure-driven separation process, into at least one product stream and at least one byproduct stream, and further wherein the enclosure further includes at least one product port adapted to permit removal from the compartment of at least one product stream and at least one byproduct port adapted to permit removal from the internal compartment of at least one byproduct stream;

at least one hydrogen-selective membrane supported within the compartment, wherein the at least one hydrogen-selective membrane includes a first surface adapted to be contacted by the mixed gas stream and a permeate surface generally opposed to the first surface, wherein the product stream is formed from a portion of the mixed gas stream that passes through the at least one hydrogen-selective membrane to the permeate surface, and the byproduct stream is formed from a portion of the mixed gas stream that does not pass through the at least one hydrogen-selective membrane, wherein the enclosure has a different composition than the at least one hydrogen-selective membrane, is formed from a composition that includes an alloy comprising nickel and copper, and has a coefficient of thermal expansion that is within approximately 10% of the

coefficient of thermal expansion of the at least one hydrogen-selective membrane; and

means for supporting the at least one hydrogen-selective membrane within the compartment, wherein the means for supporting permit the product stream to flow therethrough to the at least one product port.

2. The device of claim 1, wherein the enclosure has a coefficient of thermal expansion that is within 5% of the coefficient of thermal expansion of the at least one hydrogen-selective membrane.

3. The device of claim 2, wherein the enclosure has a coefficient of thermal expansion that is within 2% of the coefficient of thermal expansion of the at least one hydrogen-selective membrane.

4. The device of claim 1, wherein the enclosure has a coefficient of thermal expansion that is less than the coefficient of thermal expansion of the at least one hydrogen-selective membrane.

5. The device of claim 4, wherein the enclosure has a coefficient of thermal expansion that is greater than approximately 13 μm/m/°C.

6. The device of claim 1, wherein the means for supporting has a coefficient of thermal expansion that is within approximately 10% of the coefficient of thermal expansion of the at least one hydrogen-selective membrane.

7. The device of claim 1, wherein the means for supporting includes a metallic support structure.

8. The device of claim 7, wherein the support structure is at least partially formed from an alloy comprising nickel and copper.

9. The device of claim 7, wherein the support structure is not hydrogen-selective.

10. The device of claim 7, wherein the support structure includes at least one screen member.

11. The device of claim 7, wherein the support structure includes a plurality of screen members.

12. The device of claim 1, wherein the enclosure has a coefficient of thermal expansion that is less than 16 μm/m/°C.

13. The device of claim 1, wherein the enclosure further includes a perimeter shell portion interconnecting the end plates.

14. The device of claim 13, wherein each of the end plates includes a perimeter region, and further wherein at least a portion of the shell portion is integrally formed with a first one of the end plates and projects from the perimeter region thereof generally toward a second one of the end plates.

15. The device of claim 14, wherein the shell portion includes an end portion distal the first one of the end plates that is adapted to form an at least substantially fluid-tight interface with a sealing region of the second one of the end plates.

16. The device of claim 14, wherein the shell portion is a first shell portion that is integrally formed with the first one of the pair of end plates.

17. The device of claim 16, wherein the device further includes at least one seal member extending between the perimeter regions.

18. The device of claim 1, wherein the enclosure includes only a single sealed interface between the pair of end plates.

19. The device of claim 1, wherein the at least one hydrogen-selective membrane is a single membrane.

20. The device of claim 1, wherein the at least one hydrogen-selective membrane includes a pair of hydrogen-selective membranes that are oriented such that the pair of hydrogen-selective membranes are spaced-apart from each other with their permeate surfaces generally facing each other to define a membrane envelope with a harvesting conduit extending between the permeate surfaces, and further wherein the product stream is formed from the portion of the mixed gas stream that passes through the membranes to the harvesting conduit, with the remaining portion of the mixed gas stream which remains on the first surface of the membranes forming at least a portion of the byproduct stream.

21. The device of claim 20, wherein the means for supporting includes a support structure within the harvesting conduit.

22. The device of claim 21, further comprising a plurality of membrane envelopes.

23. The device of claim 1, further comprising a heating assembly adapted to heat the device to a temperature in the range of 250°C and 500° C.

24. The device of claim 23, wherein the heating assembly includes at least one electrically powered heater external the enclosure.

25. The device of claim 1, wherein at least one of the end plates includes a removed region that extends into the end plate from an interior surface thereof to provide a region through which at least a portion of the mixed gas stream may flow, and further wherein the removed region is intermediate the at least one hydrogen-selective membrane and at least one of the input, product and byproduct ports.

26. The device of claim 1, in combination with a fuel processor adapted to produce the mixed gas stream.

27. The device of claim 26, wherein the fuel processor is adapted to produce the mixed gas stream from at least one feed stream that comprises water.

28. The device of claim 26, wherein the fuel processor is adapted to produce the mixed gas stream from at least one feed stream that comprises a carbon-containing feedstock.

29. The device of claim 1, in combination with a fuel cell stack adapted to receive at least a portion of the product stream.

30. A hydrogen purification device, comprising

at least one hydrogen-selective membrane formed from an alloy comprising palladium and copper and having a coefficient of thermal expansion, wherein the at least one hydrogen-selective membrane includes a mixed gas surface that is adapted to be contacted by a mixed gas stream containing hydrogen gas and other gases, and a permeate surface that is generally opposed to the mixed gas surface;

a sealed enclosure defining an internal compartment within which the at least one hydrogen-selective membrane is supported; wherein the enclosure is adapted to receive a mixed gas stream comprising hydrogen gas and other gases and having a pressure in the range of 50 and 500 psi, wherein the enclosure includes at least one input port adapted to receive the mixed gas stream into the internal compartment, at least one product port adapted to permit removal from the compartment of a product stream comprised of a portion of the mixed gas stream that permeates through at least one hydrogen-selective membrane, and at least one byproduct port adapted to permit removal from the compartment of a byproduct stream comprised of a portion of the mixed gas stream that does not permeate through the at least one hydrogen-selective membrane, wherein the enclosure includes at least a pair of end plates, with at least one of the end plates including a removed region that extends into the end plate from the interior surface of the end plate and provides a region through which at least a portion of the mixed gas stream may flow; and

a membrane-contacting structure that is in contact with at least one of the mixed gas or the permeate surfaces of the membrane, wherein the membrane-contacting structure is selected to have a coefficient of thermal expansion that is sufficiently close to or equal to the coefficient of thermal expansion of the at least one hydrogen-selective membrane such that upon thermal cycling of the device within a temperature range of at least 200° C the membrane-contacting structure is adapted to not impart wrinkle-inducing forces to the at least one hydrogen-selective membrane.

31. The device of claim 30, wherein the membrane-contacting structure includes an alloy comprising nickel and copper.

32. The device of claim 30, wherein the membrane-contacting structure has a coefficient of thermal expansion that is the same as or less than the coefficient of thermal expansion of the at least one hydrogen-selective membrane.

33. The device of claim 30, wherein the membrane-contacting structure includes at least a portion of the enclosure.

34. The device of claim 33, wherein the enclosure is at least partially formed from an alloy comprising nickel and copper.

35. The device of claim 34, wherein the enclosure has a coefficient of thermal expansion that is the same as or less than the coefficient of thermal expansion of the at least one hydrogen-selective membrane.

36. The device of claim 30, wherein the at least one hydrogen-selective membrane is formed from an alloy comprising palladium and approximately 40 wt% copper.

37. The device of claim 30, in combination with a fuel processing assembly that is adapted to receive a feed stream and to produce the mixed gas stream therefrom.

38. The device of claim 37, wherein the fuel processing assembly is adapted to produce the mixed gas stream from at least one feed stream comprising water.

39. The device of claim 37, wherein the fuel processing assembly includes at least one reforming catalyst bed and further wherein the feed stream contains water and a carbon-containing feedstock.

40. The device of claim 39, wherein the at least one reforming catalyst bed and the enclosure are at least partially housed within a common shell.

41. The device of claim 37, in further combination with a fuel cell stack adapted to receive at least a portion of the product stream and to produce an electric current therefrom.

42. The device of claim 41, further comprising an assembly adapted to reduce the concentration of any carbon monoxide present in the product stream.

43. The device of claim 30, further comprising a heating assembly adapted to heat the enclosure.

44. The device of claim 43, wherein the heating assembly includes at least one electrically powered heater.

45. The device of claim 43, wherein the heating assembly is adapted to heat the at least one hydrogen-selective membrane to a temperature in the range of 250°C and 500° C.